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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US99/17421 (22) International Filing Date: 30 July 1999 (30.07.1999) (30) Priority Data: 09/127,362      31 July 1998 (31.07.1998) US (60) Parent Application or Grant RUPPERT, Jonathan, P. [/]; (). HINTZ, Thomas, M. [/]; (). HINTZ, Kathleen, M. [/]; (). RUPPERT, Jonathan, P. [/]; () . HINTZ, Thomas, M. [/]; (). HINTZ, Kathleen, M. [/]; (). BECK, Michael, D. ; ().	<b>Published</b>	
(54) Title: <b>WEARABLE TELECOMMUNICATIONS APPARATUS WITH VOICE/SPEECH CONTROL FEATURES</b> (54) Titre: <b>APPAREIL DE TELECOMMUNICATIONS PRET-A-PORTER A FONCTIONNALITES DE COMMANDE VOCALE</b>		
(57) Abstract <p>A wearable communication apparatus in the form of telephone headset (10) includes antenna (22), power supply (40) and electronics housing (14) for on-board electronics for RF and IR communications. Headset (10) includes mouthpiece (16) rotatably mounted to electronics housing (14). The mouthpiece includes ear speaker (20), microphone (18) and rechargeable batteries (40). Electrical contact array (50) at the end of the rotating part of mouthpiece (16) connects to electrical contact array (60) at the bottom of electronics housing (14) and activates electronics housing (14) when mouthpiece (6) is rotated into a speaking position. In deactivated position electrical contact array (50) engages complementary contact array (80) in base unit (70) for recharging as indicated by the illumination of indicator light (82).</p> <p>(57) Abrégé</p> <p>La présente invention concerne un appareil de communication prêt-à-porter se présentant sous la forme d'un écouteur téléphonique (10) comprenant une antenne (22), une alimentation (40) et un boîtier de circuits électroniques (14) abritant des circuits électroniques internes de communication HF et IR. L'écouteur téléphonique (10) comporte une embouchure (16) montée rotative sur le boîtier de circuits électroniques (14). L'embouchure comprend un haut-parleur auriculaire (20), un microphone (18) et des piles rechargeables (40). Un réseau de contacts électriques (50) situé à une extrémité de la partie rotative de l'embouchure (16) est relié à un réseau de contacts électriques (60) situé dans le fond du boîtier de circuits électroniques (14) et active le boîtier de circuits électroniques (14) lorsque l'embouchure (6) est tournée dans la position de parole. Dans la position désactivée, le réseau de contacts électriques (50) est placé en contact avec un réseau de contacts complémentaires (80) situé dans une unité de base (70) pour la recharge, recharge qui est indiquée par l'illumination d'un indicateur lumineux (82).</p>		

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(54) Title: <b>WEARABLE TELECOMMUNICATIONS APPARATUS WITH VOICE/SPEECH CONTROL FEATURES</b>			
(57) Abstract			
<p>A wearable communication apparatus in the form of telephone headset (10) includes antenna (22), power supply (40) and electronics housing (14) for on-board electronics for RF and IR communications. Headset (10) includes mouthpiece (16) rotatably mounted to electronics housing (14). The mouthpiece includes ear speaker (20), microphone (18) and rechargeable batteries (40). Electrical contact array (50) at the end of the rotating part of mouthpiece (16) connects to electrical contact array (60) at the bottom of electronics housing (14) and activates electronics housing (14) when mouthpiece (6) is rotated into a speaking position. In deactivated position electrical contact array (50) engages complementary contact array (80) in base unit (70) for recharging as indicated by the illumination of indicator light (82).</p>			

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## Description

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## Wearable Telecommunications Apparatus With Voice/Speech Control Features

### Reference to Related Applications

Subject matter in the present application is included in Disclosure Document No. 403212, filed on August 1, 1996.

### Background of the Invention

This invention relates generally to the field of telephony, and more particularly to an apparatus integrating voice recognition, cellular phone technology and telephone headsets.

Presently, a plurality of headset devices are available for use in a typical PBX or telephone system. A variety of such headsets are disclosed in the Hello Direct Catalog, Spring 1997, and in U.S. patent 4,882,745 to Silver. In U.S. patent 5,487,102 to Rothschild, Ralph F., et al., a headset interface is disclosed that is connected to the public telephone network at a central office. The system includes automated voice features that alleviates the need for an operator to vocalize greetings and responses to users of the telephone system. This system relies upon standard ground-line based telephony, rather than cellular technology.

Cellular technology has been widely applied to car telephone systems. For example, a standard car mounted cell phone with a keypad on the hand set is disclosed in U.S. patent 5,335,261 to Fujinaka. Dialing a phone number via the keypad is awkward and potentially unsafe while operating a moving vehicle. Even when the portable phone is removed from the vehicle-mounted base, the cell phone mounted keypad still presents the same difficulties to dialing while a person is in motion or in an environment where being visually distracted can be problematic. The cell phone system in the '261

Patent includes a speaker phone feature that frees a driver from having to hold the phone in the car, but this feature only adds marginally to the overall convenience and safety of the device.

Telephone headsets have been proposed for use with cellular systems, such as the system disclosed in U.S. patent 5,191,602 to Regen et al. The headset shown in this patent fails to eliminate many of the problems of using a cellular device. For example, when using the cellular phone in an automobile, the driver is required to be connected to a slave unit containing electronic circuitry that purports to provide a transparent interface between the headset and the existing cell phone. With this system, the headset is directly connected by a cord to the cellular device. Moreover, as with a standard car phone, the user of the headset shown in the '602 Patent is still required to dial using the keypad on the cellular device.

So-called "wearable" cellular phones have been recently promoted. One such compact telephone can be worn as a necklace around the neck. The device described in the article is not useable when being worn. Additionally a conventional extendable antenna is required along with a keypad for dialing. This invention is consistent with the current state of the art devices that require the user to use their hands to operate the device.

In U.S. patent 5,042,063 to Sakanishi, a telephone apparatus is disclosed in which a call may be made in response to utterances of a user by speech recognition without manually dialing a telephone number. However, the system still requires some keypad functions in order to communicate, so that it does not permit true hands free operation.

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### Summary of the Invention

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In view of the limitations of the prior communication systems, the present invention contemplates a highly flexible headset communication apparatus. The headset apparatus is self-contained, meaning that it includes its own power source, communications link and circuitry to maintain remote, non-land based communications. In one application, the headset apparatus of the present invention permits use with a base unit linked to an office or landline telephone system. The same headset can be used for remote cellular communication outside the office.

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In one embodiment, the headset apparatus includes a port and circuitry for I/R communications with external hardware. For example, in one mode of operation, the user can send and receive data to and from a personal computer, or an ATM.

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In one important feature of the invention, the headset is provided with electronics/software for voice recognition. The headset permits voice activation of the headset, voice dialing and audible commands. The apparatus includes electronics to recognize whether the user has issued a voice command, to determine the nature of the audible command, and to control the operation of the headset in response to the spoken word. In one embodiment, the headset apparatus can distinguish between spoken numbers and spoken words. The headset includes electronics to permit spoken number dialing, and to access a database of telephone numbers referenced by spoken words.

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In conjunction with the voice recognition features, the headset includes electronics and software for user recording of voice commands. A voice recognition processing unit (VRPU) within the headset processes verbal input and stores a translated version of the spoken words in a local memory. The VRPU can then compare future spoken commands with the translated version in memory to then issue an appropriate electronic command to the headset components.

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In one beneficial feature of the invention, advanced antenna technology incorporated into the headset. The advanced antenna overcomes interference and signal degradation that is typically associated with cellular communications. A renewable power supply, such as a rechargeable lithium battery, adds to the flexibility of the inventive telephone headset.

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In another feature of the invention, the headset includes a mouthpiece that is rotatably connected to the central housing of the apparatus. The mouthpiece includes a housing end that fits within a complementary configured recess in the housing. An array of electrical contacts are disposed on both the housing recess and the housing end of the mouthpiece. The electrical contacts transmitted electrical energy between the components in the central housing and the components in the mouthpiece, such as the ear speaker and microphone. In addition, the headset apparatus can be energized or de-energized by rotating the electrical contact arrays into and out of electrical connection.

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In one feature associated with the rotatable mouthpiece, the electrical contacts at the housing end are arranged to contact corresponding electrical contacts on the base unit. With the mouthpiece rotated into a position in which the headset is not energized by its own power supply, the headset can be linked to the base unit. The base unit can be used to recharge the on-board power supply of the headset. In addition, the base unit can be used to maintain communication through the headset speaker and microphone.

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It is an object of the present invention to provide a highly integrated wearable cellular telephone apparatus that is incorporated into a headset. Having the power source, control circuitry and antenna built in to the headset offers a significantly compact and portable communication device that can be operated safely in or out of a vehicle or the office.

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It is a further object of the invention to provide a wearable

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communication system which reduces need for having a separate phone device for your vehicle, home, office or other locations to be fixed. Features of the system allow connection to a PBX or use as a remote stand-alone cellular phone.

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5 It is further an object of the present invention to function with a wireless infrared communication port to transmit data from a computer laptop or other device and to forward the data via the cellular network to other computers or systems.

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10 One benefit of the present invention is achieved by features of the wearable headset that permit voice activated commands. Other objects and advantages will become apparent from a consideration of the ensuing description and accompanying drawings.

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### Description of the Figures

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**FIG. 1** is an exploded perspective view of the components of a cellular headset according to one embodiment of the present invention.

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**FIG. 2** is a partial exploded view of the electrical contacts between the mouthpiece and the electronics housing.

**FIG. 3** is a top perspective view of a base unit for use with the cellular headset shown in **FIG. 1**.

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**FIG. 4** is a side elevational view of the headset shown in **FIG. 1** mounted on the base unit shown in **FIG. 3**.

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**FIG. 5** is a diagrammatic representation of the electronic components of the cellular headset shown in **FIG. 1**.

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**FIG. 6** is a generalized flowchart of the functions performed by the electronics diagrammed in **FIG. 5**.

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**FIG. 7** is a detailed flowchart of one step shown in the flowchart of **FIG. 6** for executing voice commands.

**FIG. 8** is a detailed flowchart of a further step shown in the flowchart of **FIG. 6** for executing recording commands.

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**FIG. 9** is a detailed flowchart of another step shown in the flowchart of **FIG. 6** for executing voice-activated controls.

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### Description of the Preferred Embodiment

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to one preferred embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated embodiment, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

In accordance with one embodiment of the invention, a telephone headset **10** is provided with a headband **12** configured to be supported on the head of a user. The headband **12** is attached to an electronics housing **14** that contains electronic components used with the telephone headset **10**. The electronics housing **14** pivotally supports a movable mouthpiece **16** that is configured to wrap around from the side of the face of the user to the front adjacent the user's mouth. The mouthpiece **16** includes a microphone **18** that is mounted at the end of the mouthpiece. Thus, it should be apparent that the mouthpiece **16** is configured so that the microphone **18** can be disposed immediately adjacent the mouth of the user. In one specific embodiment, the microphone **18** is a sub-miniature condenser microphone having an even cardioid unit directional response over the speech bandwidth. In this specific embodiment, the microphone **18** assures extremely low sensitivity to mechanical vibration and reduces handling noise as the mouthpiece **16** is manipulated. In a further specific embodiment, the microphone **18** can include a back-electret element and an integral preamplifier for a refined and accurate signal.

The telephone headset **10** further includes an ear speaker **20** that is engaged within the mouthpiece **16** at the opposite end from the

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microphone 18. An ear cushion 21 is provided so that the microphone can be supported and seated against the ear of the user. The headband 12 is provided in adjustable sections. The band includes a fixed section 12a that is attached to the electronics housing 14. A strap 12b extends from the fixed section and is adjustably engaged by a movable section 12c. In this respect, the headband 12 can be of a conventional design to permit adjustment to accommodate the head of the user. The movable section 12c can be provided with a counterweight at its free end to balance the weight of the headset components on the user's head.

In the preferred embodiment, the fixed section 12a is engaged to the electronics housing 14 by way of a pair of attachment pins 25 and corresponding attachment recesses 26. In the illustrated embodiment, the pins 25 are shown as extending from the electronics housing 14, while the recesses are disposed within the fixed section 12a of the headband 12. Of course, the pins and recesses can be reversed in their location. In this embodiment, the pins are configured for removable press fit engagement within a corresponding recess to firmly hold the headband 12 and electronics housing 14 together.

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In one feature of the invention, the telephone headset 10 is provided with an antenna 22 that is disposed within the headband 12, and preferably the fixed section 12a. In one specific embodiment, the antenna 22 can utilize advanced strip technology to reduce the profile of the antenna to fit within the headband 12. Two sets of mating contacts 28 and 29 are respectively connected to the headband 12 and electronics housing 14. These contacts provide electrical connection between the antenna 22 and electronics disposed within the electronics housing 14.

Looking again at the mouthpiece 16, a housing 34 is provided adjacent the speaker 20. The housing preferably includes means for supporting the speaker 20 at one face of the housing (not shown). The

housing 34 further defines a battery compartment 35 for receiving battery cells 40. Preferably, the batteries 40 are capable of providing five volts DC power to the electronics of the telephone headset 10. In specific embodiments, the batteries can be standard lithium disk cells, as depicted in FIG. 1. In an alternative embodiment, the disk cells can be replaced by a conformal battery that is configured to fit within the electronics housing 14 or a component of the headband 12.

The electronics housing 14 defines a hinged recess 37 within which the housing 34 of the mouthpiece 16 can rotatably reside. The electronics housing 14 further provides a compartment for housing a cellular communication electronics component 30 and a headphone control electronics component 32. Preferably, these two components 30, 32 are standard integrated circuit boards carrying the various electronic components for the appointed functions.

The battery compartment 35 of the housing 34 is closed by a cap 42. The cap 42 includes a cylindrical hinge portion 43 that is preferably configured to be pressed into the battery compartment 35. In a specific embodiment, the hinge portion 43 and the battery compartment 35 can form a circumferential pivoting hinge, such as a ridge and groove configuration, so that the mouthpiece 16 can be pivoted in the direction of the arrow A about the hinge portion 43.

The cap 42 further includes an attachment plate 44 providing a means for supporting the hinge portion 43 relative to the electronics housing 14. The attachment plate 44 can include a plurality of pins 45 that are adapted to be press fit into corresponding recesses 47 defined in the electronics housing 14. The attachment plate 44 is configured so that the housing 34 pivots in close proximity and preferably direct contact with the hinge recess 37 of the electronics housing 14. It is understood that the cap 42, with its hinge portion 43 and attachment plate 44, is one manner for pivotably supporting the mouthpiece 16 relative to the electronics housing 14. Other hinge type supports are

contemplated, provided that they maintain a direct pivoting contact between the housing 34 and the hinge recess 37.

The importance of this direct contact can be appreciated with reference to the electrical contact array 50 that is disposed on the outer portion of the housing 34. This contact array 50 is in direct electrical connection with a corresponding contact array 60 mounted to the surface of the hinge recess 37 of the electronics housing 14. The relationship between the two contact arrays 50 and 60 are shown in the detailed view of FIG. 2. The contact array 50 can include individual electrical contacts 50<sub>A</sub>-50<sub>E</sub> (note that contact 50<sub>E</sub> is hidden from view in FIG. 2). A corresponding number of contacts 60<sub>A</sub>-60<sub>E</sub> are provided in the array 60 in the electronics housing 14. In a specific embodiment, the contacts 50<sub>A</sub> and 60<sub>A</sub> can correspond to an electrical interface with the microphone 18. The contacts 50<sub>B</sub> and 60<sub>B</sub> provide volume control, while the contacts 50<sub>C</sub> and 60<sub>C</sub> are the electrical connections for the speaker 20. The final pair of contacts in each array is power contacts.

Each of the electrical contacts in the two arrays 50 and 60 can be of conventional design that provides for direct sliding contact. In one specific embodiment, the contacts 60<sub>A</sub>-60<sub>E</sub> can be somewhat elongated around the inner circumference of the hinge recess 37. In this manner, direct electrical connection with the corresponding contact 50<sub>A</sub>-50<sub>E</sub> can be maintained even as the mouthpiece 16 is pivoted relative to the housing 14.

The telephone headset 10 can include a pair of volume control buttons 52 and 54 mounted to the mouthpiece 16. The pushbutton switches can be used to increase the volume heard through the speaker 20. Signals from the volume control switches are passed to the headphone control electronics component 32 by way of the electrical contacts 50<sub>B</sub> and 60<sub>B</sub>. Similarly, signals from the microphone 18 are passed to the electronics component 32 through the contacts 50<sub>A</sub> and

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60<sub>A</sub>, while signals travel to the speaker 20 by way of the electrical contacts 50<sub>C</sub> and 60<sub>C</sub>.

The electronics housing 14 can carry an array of visual indicators. For example, a power indicator 56 can be provided to indicate that the phone headset is activated. This activation occurs when the mouthpiece 16 is pivoted relative to the electronics housing 14 so that the power electrical contacts 50<sub>D,E</sub> engage the contacts 60<sub>D,E</sub>. When the headset 10 is in use for telephone communication or other type of data transmission, a busy indicator light 58 can be illuminated by circuitry within the electronics component 32. In the case of both indicators 56 and 58, a low-power LED can be utilized. In other specific adaptations, the LEDs can be illuminated in different colors to provide different indications. For example, the power LED 56 can be red when the telephone headset 10 is activated, and green when the batteries 40 are low on charge. Similarly, the in use LED 58 can be illuminated red when the user is making use of the headset 10 and can be illuminated a flashing green when an incoming call is being received by the unit. Of course it is understood that both the electronics housing 14 and the mouthpiece 16 can be provided with other visual indicators, such as the LEDs 56 and 58, to act as annunciators for various functions of the telephone headset 10.

A further component of the present invention is the base unit 70 shown in FIG. 3. The base unit 70 can include a power input 71 which can provide for connection to an AC source of power. The unit also includes a retractable and extendable antenna 72 to provide a communication link to the telephone headset 10 by way of the antenna 22. The base unit can also include a microphone 74 and a speaker 75 to establish two-way communication between the base unit and a variety of telephone headsets 10. Two volume control switches 76 and 77 can also be provided to adjust the volume of the signal received over the speaker 75.

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In one feature of the invention, the base unit **70** provides a means for supporting and providing electrical contact with the telephone headset **10**. Specifically, an array of contacts **80<sub>A</sub>-80<sub>E</sub>** is provided within a support recess **81** defined in the top face of the base unit **70**. The support recess **81** is configured to receive a portion of the housing **34** of the mouthpiece **16**, in a manner shown in **FIG. 4**. In this configuration, the mouthpiece **16** is pivoted upward in the direction of the arrow **A** in **FIG. 1** so that the arm of the mouthpiece substantially overlies the electronics housing **14**. In this orientation, the electrical contact array **50** is exposed beneath the telephone headset **10**. When the headset **10** is mounted within the support recess **81**, the electrical contact array **50** is exposed to and in electrical contact with the corresponding electrical contacts in the base unit **70**. Thus, the corresponding contacts **50<sub>A</sub>, 50<sub>B</sub>** have complimentary mating contacts **80<sub>A</sub>, 80<sub>E</sub>** within the base unit. The power and ground contacts **80<sub>D</sub>** and **80<sub>E</sub>** of the base unit are used to provide a recharging capability for the batteries **40** of the telephone headset **10**. Thus, in this instance, the batteries **40** are preferably rechargeable lithium type batteries. When the telephone headset **10** is mounted within the base unit **70** for recharging, an indicator light **82** can be illuminated to shown the recharging function is occurring. With the telephone headset **10** mounted to the base unit **70**, the microphone and speaker of the telephone headset **10** are electrically connected to the base unit, rather than to the control electronics component **32** of the telephone headset **10**.

In further features of the base unit **70**, a display **84** can be provided for various messages. Circuitry within the base unit **70** can provide messages on the display **84** to indicate the origination of an incoming call, the duration of a call, and other information of interest.

So that the base unit **70** can operate within a telephone system, it is provided with a jack **85** for engaging a conventional telephone ground wire. This jack **85** can be an RJ45 jack as is known in the art.

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In addition, the base unit **70** is provided with a serial interface jack **86** that can be engaged by a serial cable to a data source, such as a personal computer. In this respect, the base unit **70** can be used to transmit serial data to a telephone headset **10**. To effect this function, the base unit **70** includes an I/R interface **88** that can transmit an infrared signal to a telephone headset **10**. The headset **10** can therefore be provided with a corresponding I/R interface **89**, located on the underside of the mouthpiece **16**. Circuitry within the headphone control electronics component **32** can be used to receive and condition signals transmitted via the I/R interfaces **88** and **89**. In this aspect, the signals can pass from the mouthpiece **16** to the electronics housing **14** through the microphone contacts **50<sub>A</sub>** and **60<sub>A</sub>**.

It is understood that the I/R port **89** in the telephone headset **10** can be situated in a variety of locations on the headset. In addition, multiple I/R ports can be provided for greater ease of use of this communication aspect. If properly located on the headset, the I/R ports provide means for headset-to-headset communications. The I/R port **89** can also provide an interface to I/R ports on other data transmission devices, such as computers, printers, ATMs and the like. Using components of the headset described herein, a user can enable half or full-duplex communication with a computer or peripheral device. The I/R port can transmit verbalized commands that have been translated using speech synthesizer technology, to control the computer or peripheral.

Referring now to **FIG. 5**, the general electronics of the telephone headset **10** are depicted diagrammatically. As indicated above, the telephone headset **10** includes a cellular communication electronics component **30** that includes circuitry for receiving and processing cellular communications over the antenna **22**. In one specific embodiment, the cellular component **30** is integrated with RF interface control circuitry **90** that provide for reception and transmission of RF

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signals over the antenna 22. Such RF control circuitry 90 is well known in the art, as is the electronics necessary for the cellular interface, as part of the cellular communication electronics component 30. Again, as indicated above, this component is provided as an integrated circuit board or wafer that is configured to be mounted within the electronics housing 14 of the telephone headset 10. The cellular communication component 30 also controls a ring indicator 92. The ring indicator can be a typical electro-mechanical device that provides an audible sound when a cellular telephone transmission is being received at the antenna 22. The indicator 92 can also constitute or include a vibratory indicator that vibrates when an incoming call is received

Signals processed by the cellular interface component 30 are transmitted to the headphone control electronics component 32 for additional processing and transmittal to and from the microphone 18 and speaker 20. The electronics component 32 is powered by a battery 40, with the control electronics component 32 distributing power to the remaining electrical components of the telephone headset 10.

The headphone control electronics component 32 can be provided with a separate power on/off switch 95 (not shown). However, most preferably, the power on/off switch 95 is integrated with the contacts 60<sub>D</sub> and 60<sub>E</sub>. When the power circuit is completed through the contacts 50<sub>D</sub> and 50<sub>E</sub> of the mouthpiece 16, the power switch 95 is activated. In this instance, a signal is provided to the electronics component 32, which then illuminates the appropriate LED indicator 56, 58. When the telephone headset 10 is mounted on the base unit 70, the control electronics 32 can also be used to drive the LED display 84 mounted to the base unit 70. In addition, the telephone headset 10 can be provided with I/R interface circuitry 97 that process I/R signals through the control electronics component 32.

In one important aspect of the invention, the microphone 18 and speaker 20 are electrically connected to the control electronics

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component 32 by way of a voice recognition processing unit 100. The VRPU 100 can be provided with an optional RAM memory 101 for storing a variety of voice recognition information, as described in more detail below. The VRPU 100 provides an important benefit to telephone headset 10 of the present invention. Specifically, the VRPU can translate audible instructions into electronic instructions to direct the mode of operation of an activity of the telephone headset 10. In this way, the telephone headset 10 is truly a hands-free cellular telephone, in contrast to the traditional prior cellular phone that utilizes a keypad for data entry.

The voice recognition processing unit 100 can include a number of application specific integrated circuits (ASIC) to perform a variety of voice recognition functions. For example, one ASIC can be utilized for electronic dialing. This particular ASIC is configured to recognize spoken numbers corresponding to a telephone dialing command. A second ASIC can provide for general speech recognition to recognize specific commands used to operate the telephone headset. A third ASIC can provide means for programming the memory 101 of the VRPU 100 to store various spoken numbers and word commands. A further ASIC can process a variety of spoken instructions for controlling certain functions of the telephone headset 10. Each ASIC includes circuitry for recognizing and processing spoken numbers and words and providing an appropriate signal to the headphone control electronics component 32 for subsequent electrical processing.

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The VRPU 100 can also include voice recognition ASICs that permit the headset to "speak" to the user. For example, when an incoming call is received by the cellular interface unit 30, a signal can be generated by the VRPU directing speech simulation software to send an audible, spoken message to the speaker 20. For instance, the message can be the words "You have a call". Other spoken messages

can be generated by the headset VRPU 100 depending upon the headset activity.

In one specific embodiment, the electronics of the control electronics component 32 and the VRPU 100 execute a sequence of general instructions as shown in FIG. 6. When power to the unit is activated in the initial step 110, the power on indicator LED is illuminated in step 112. In the subsequent steps 114, 116 and 118, the various electrical components of the telephone headset 10 are activated, specifically, the mouthpiece 16 is activated at the hook on step, the microphone in the next step, and the volume controls in step 118.

In the following steps 120, 122 and 124, a command recognition ASIC within the VRPU 100 determines whether a spoken command is given corresponding to one of the three illustrated functions.

Specifically, the recognition ASIC determines whether a voice dial command is being requested in step 120, a recording command is issued in step 122, or further telephone headset control commands being expressed in step 124. If no audible commands are issued, the telephone headset 10 goes into a standby mode 126. The standby mode is controlled by the control electronics component 32 which permits reduced power usage while keeping the telephone headset 10 activated to receive incoming calls. Once an incoming call is received by the cellular interface component 30, the incoming signal awakes the control electronics component 32 so that full power can be supplied to the remaining electronics of the telephone headset 10.

Referring now to FIG. 7, a flowchart of commands executed by a dialing ASIC within the VRPU 100 is illustrated. If a voice dial command is issued in step 120 (FIG. 6), control is passed to the dialing ASIC which is placed in step 130 in a ready mode to receive a dial command. This control transfer can be initiated by an audible command such as "dial" which is recognized by the command control ASIC. Once control

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is passed to the dialing ASIC, a determination is made as to whether the next verbal intonation by the user is a number or a word command. A test is conducted in step 132 to determine whether the spoken input is a number command. Thus, the dialing ASIC 66 will include an array of recognized numbers as spoken by the particular user, i.e. "one", "two", etc. If the dialing ASIC recognizes a number, control passes to step 134 in which the spoken number is converted to an electronic dialing command to dial the spoken number. Once the number has been dialed, the voice dialing sequence is turned off in step 136 so that any further spoken numbers by the user will not be interpreted as a dialing command. At this point, direct voice communication can be conducted by the user through the telephone headset 10. In an optional step 138, a voice synthesizer within the VRPU 100 can be activated. The voice synthesizer can issue audible requests through the speaker 20. For example, in step 140, the voice synthesizer can request whether any new numbers need to be dialed by the dialing ASIC. If the answer is yes, then control passes back to step 134 in which the number is spoken by the user and dialed by the dialing ASIC. The voice synthesizer can further request in step 142 whether the user is finished with the current conversation. If the enunciated answer is yes, then control passes to the standby mode at step 144.

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Referring back to the beginning of the flowchart in FIG. 7, if a number command is not issued to the ASIC in step 132, control passes to step 150. In this step it is determined whether a word command is being issued that is recognized by the VRPU 100. If no word is uttered, control passes down to step 160. On the other hand, if a word dialing command is issued in step 150, control passes to the next step 152 in which the spoken word is looked up within the memory 101. At this instance, the word command can simply be the name of a person to be called. This name can be stored within a look-up table in the RAM memory 101 to be accessed by the VRPU 100. The dialing ASIC determines a match between the spoken word and the stored word, and

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the appropriate telephone number is electronically extracted from the memory 101. In the next step this number is passed to the control electronics component 32 to perform the dialing function. As with the branch corresponding to number commands, the voice dialing activation is turned off in step 156 and the voice synthesizer activated in step 158. In step 160 the dialing ASIC requests whether the user is done with the conversation, and if the answer is yes the telephone headset 10 is passed to the standby mode in the final step 162.

When the telephone headset 10 is first activated by a user, it must be educated as to the user's voice. Thus, if no voice dialing commands are being issued in the flowchart of FIG. 6, then the next step 122 is used to determine whether any record commands are being issued by the user. If so, then control passes to the recording ASIC whose executed steps are shown in FIG. 8. In this step, the voice activated recording commands are turned on in step 170. In the next step 172, the recording ASIC determines whether any recordable voice signals are being received. If so, it is determined in step 174 whether the next spoken words are to be recorded. If so, the user speaks the words and they are stored within the memory 101 in step 176. If the user desires to change the particular recorded words, the last entered information can be erased in step 178. In the following step 180, it is determined whether any new recordings are to be made. If not, control passes to step 182 in which the telephone headset 10 is placed in the standby mode.

Referring back to FIG. 6, step 124 determines whether any specific control commands have been issued by the user. If so, then the control command ASIC is activated to follow the steps shown in FIG. 9. Once the control command ASIC is activated in step 185, it is determined whether any new commands have been issued by the user in step 187. If so, the voice command is received in step 189, and the memory 101 is searched in step 190 to find a match for the particular

voice command. In one specific embodiment, these commands can be to activate various RF controls in step 192 or to activate I/R controls in step 194. Depending upon which controls are activated, the spoken voice command is converted to an electronic signal which is then passed to the appropriate control in step 196. After the control signals have been received by either the RF or I/R control circuitry, the corresponding controls are deactivated in steps 198 and 200. If no further commands are received in step 202, the telephone headset 10 passes to the standby mode in step 204. The audible commands executed by the command control ASIC according to the steps in FIG. 9 can correspond to commands for tuning the RF reception of the telephone headset 10 to a particular base unit 70. In addition, when I/R controls are activated, the commands can give effect to various data transmissions over the I/R channel between the base unit 70 and the telephone headset 10. In some cases, the I/R channel can be used to transmit data to the base unit 70 and through the serial interface 86 to a personal computer. Such data can be spoken words processed through speech synthesizer software to be downloaded to the PC, for subsequent transcription, for instance.

20 The present invention provides the user with a highly flexible communications device that is not constrained by conventional telephone system limits. For example, the headset 10 can be used in the office and integrated into the local PBX system through the base unit 70. The base unit can be programmed to communicate with the headset on a cellular frequency. The headset allows the user to receive or continue a call anywhere in the office. The same headset can be used for remote cellular communication outside the office. The microprocessor 30 of the headset can issue commands to the cellular interface unit 30 to recognize when the unit is being used as part of the office telephone system and as a remote cellular unit.

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The I/R port **89** adds a further dimension to the flexible communications achieved by the present invention. The I/R port permits communication that is not frequency dependent. In other words, while RF or cellular communication requires a unit specific address frequency, I/R communication requires no such limiting address. Thus, two headsets can communicate with each other, or a single base unit **70** can issue broadcast communications over the I/R band. Again, the microprocessor **30** of each headset can include software to recognize that an I/R transmission is being received. Various transmission protocols can be implemented to enable the headset to awake from a standby mode and activate the appropriate IR interface circuitry. If security is an issue, the I/R transmission packets can include password information recognizable only by a specific headset.

While the invention has been illustrated and described in detail in the foregoing drawings and description, the same is to be considered as illustrative and not restrictive in character, it being understood that only preferred embodiments thereof have been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

**Claims**

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**What is claimed is:**

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1. A wearable communication apparatus comprising:

a mouthpiece having a first end and a second end, and including  
a speaker disposed adjacent said first end and a microphone disposed  
adjacent said second end;

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a central housing having a top end and a bottom end;

means between said first end of said mouthpiece and said  
bottom end of said central housing for pivotably mounting said  
mouthpiece to said central housing, said mouthpiece pivotable to a first  
position in which said microphone is adjacent the mouth of a user of the  
apparatus;

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a head-band connected to said top end of said central housing  
and configured for supporting the apparatus on the head of a user;

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an antenna;

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electronic communication means for sending and receiving  
signals through said antenna, for controlling said speaker in response to  
received signals and for transmitting signals from said microphone for  
broadcast over said antenna.

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2. The wearable communications apparatus according to claim  
1, wherein:

said mouthpiece includes a first electrical contact array at said  
first end, said contact array connected to at least said speaker and said  
microphone; and

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said central housing including a corresponding second electrical  
contact array arranged to provide electrical connection with said first  
contact array when said mouthpiece is in said first position.

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3. The wearable communications apparatus according to claim 2, wherein:

said mouthpiece contains a power supply; and  
said first and second contact arrays include a number of contacts in electrical communication with said power supply when said mouthpiece is in said first position.

4. The wearable communications apparatus according to claim 1, wherein:

said electronic communications means includes a voice recognition processing unit connectable to said mouthpiece through said first and second contact arrays when said mouthpiece is in said first position,

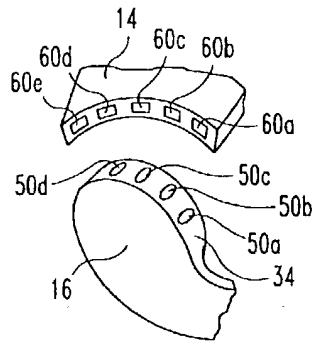
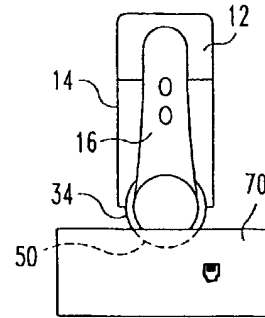
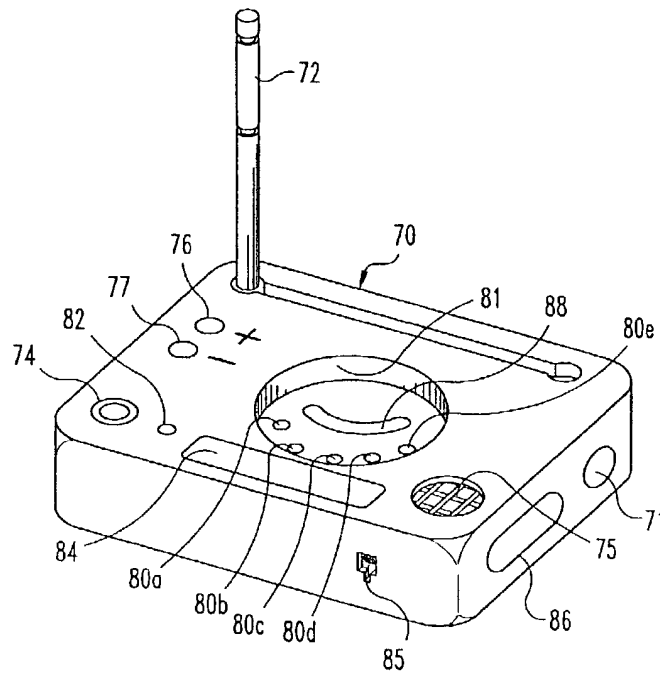
said voice recognition processing unit operable to translate verbal utterances received by said microphone into electrical signals usable by said electronic communications means.

5. The wearable communications apparatus according to claim 1, further comprising a base unit, said base unit having means for connection to an existing telephone network, an antenna and means for transmitting signals from the existing network to the antenna for broadcast to said headset.

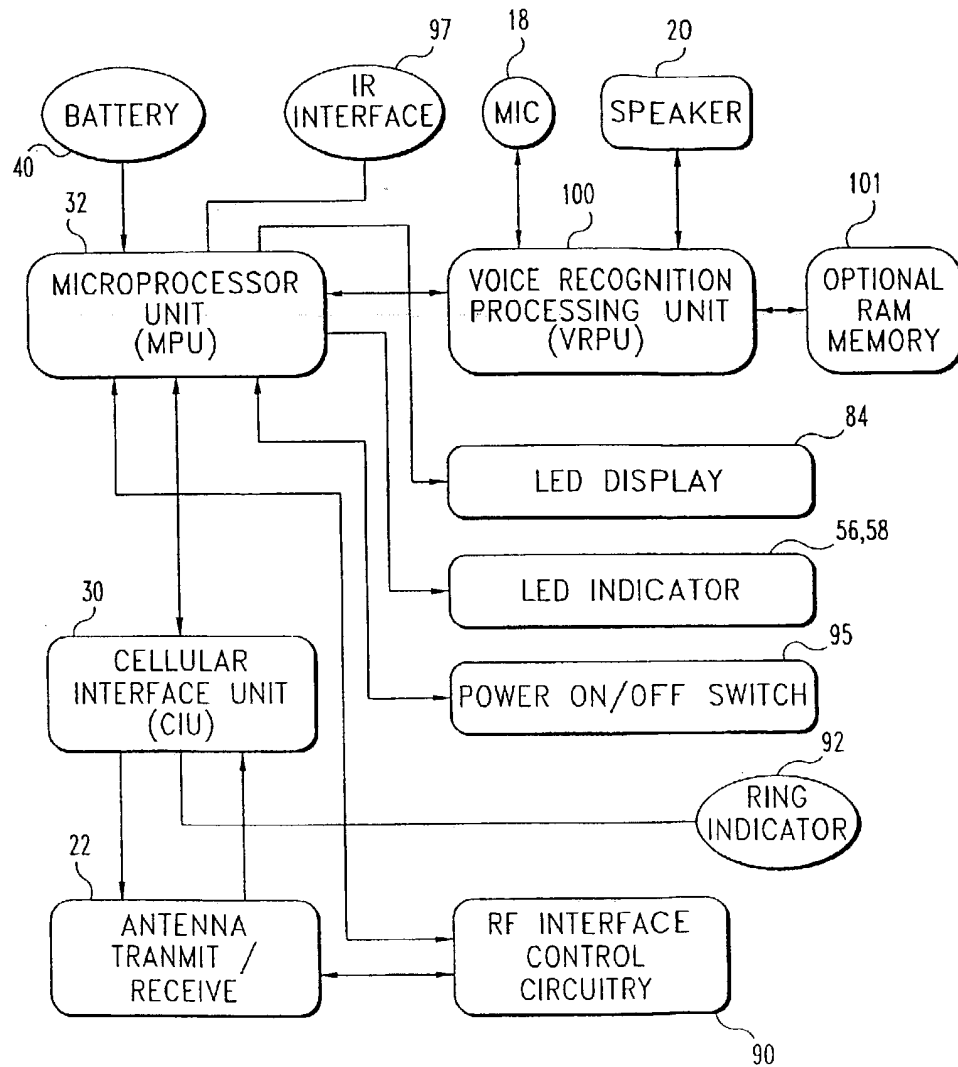
6. The wearable communications apparatus according to claim 5, wherein;

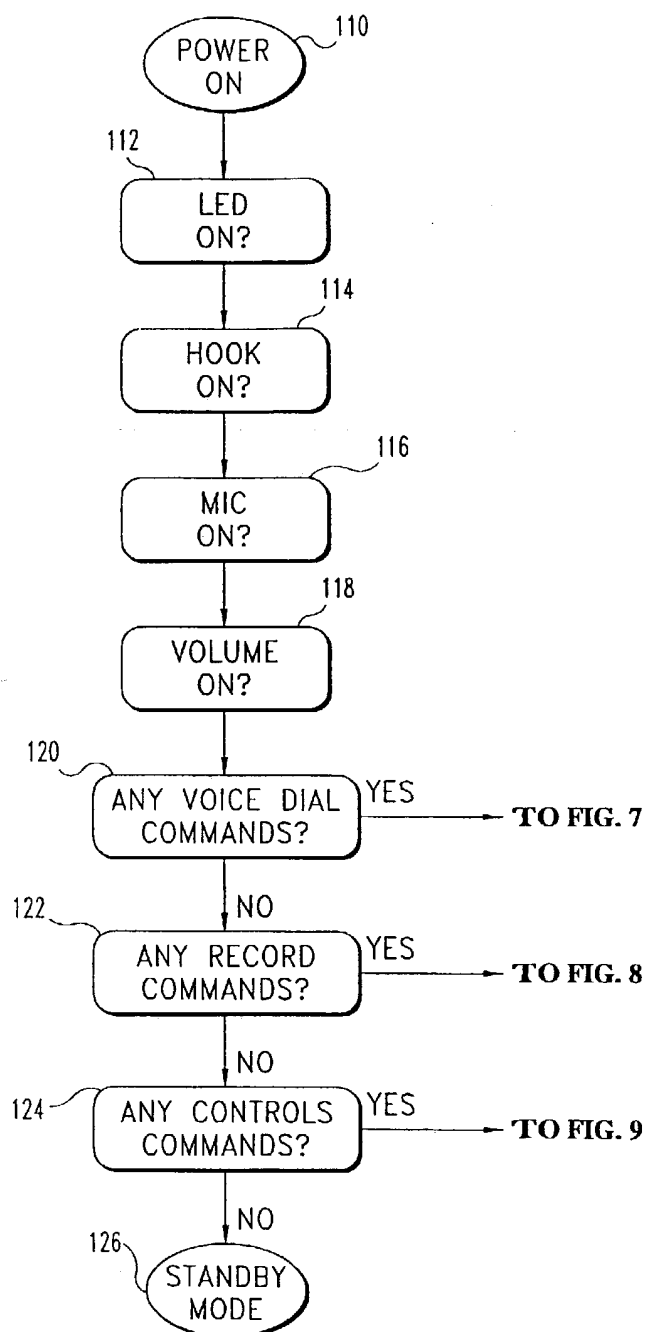
said base unit includes a third electrical contact array corresponding to said first contact array; and  
means for supporting said mouthpiece when said mouthpiece is rotated to a second position in which said first and second contact arrays are not in electrical contact, whereby said first and third contact arrays are in electrical contact in said second position.



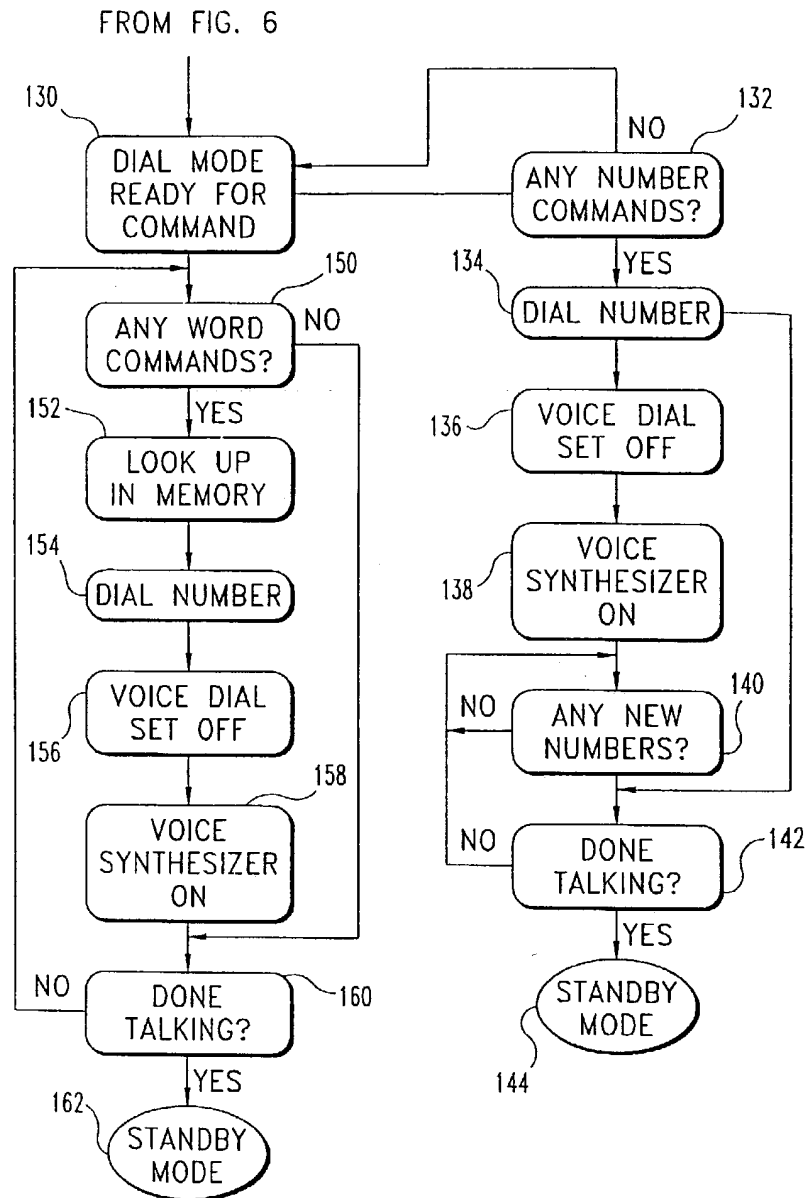
**Fig. 2****Fig. 4****Fig. 3**

SUBSTITUTE SHEET (RULE 26)

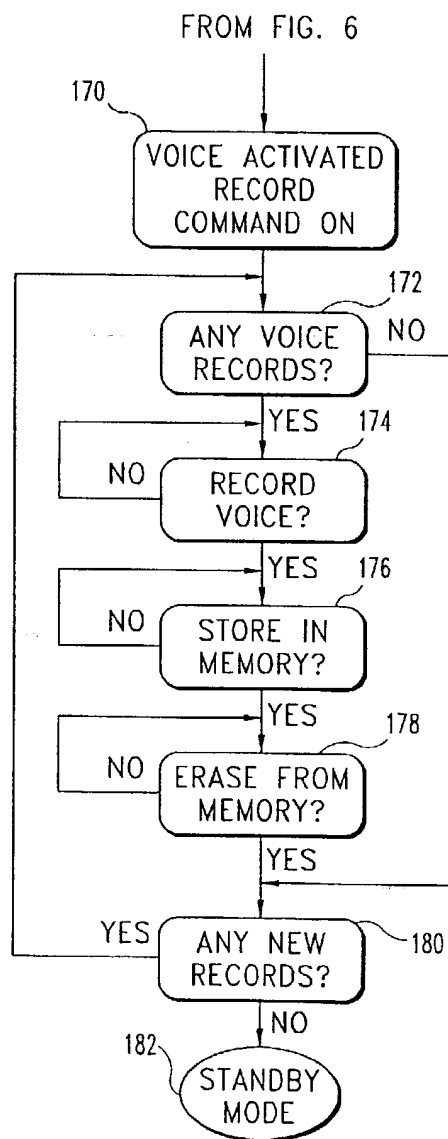
**Fig. 5**



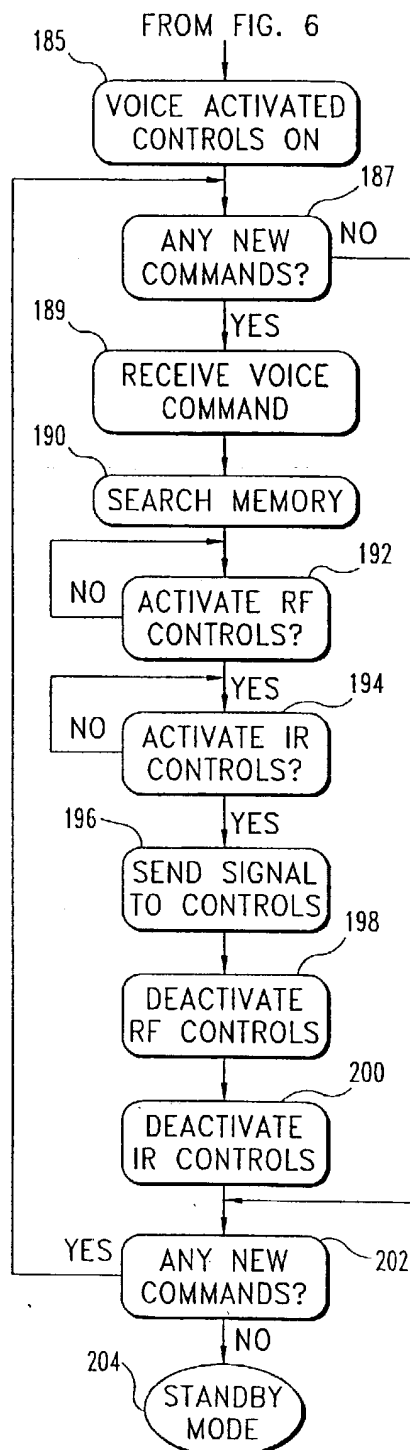
**Fig. 6**  
SUBSTITUTE SHEET (RULE 26)

**Fig. 7**

SUBSTITUTE SHEET (RULE 26)

**Fig. 8**

SUBSTITUTE SHEET (RULE 26)



SUBSTITUTE SHEET (RULE 26)

**Fig. 9**

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/17421

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :G10L 3/00

US CL :704/275

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 704/275, 455/79; 455/90; 379/61

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST, APS, STN, DIALOG

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 4,484,029 A (KENNEY) 20 November 1984 col. 2, line 27 - col. 4, line 5.	1-2 --- 3-6
Y	US 4,945,570 A (GERSON et al) 31 July 1990, col. 4, lines 26-51	4
Y	US 4,882,745 A (SILVER) 21 November 1989, col. 3, line 49 - col. 4, line 14.	3, 5 and 6

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*E* earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*A* document member of the same patent family
*O* document referring to an oral disclosure, use, exhibition or other means	
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

09 SEPTEMBER 1999

Date of mailing of the international search report

20 OCT 1999

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